RF Gauging of the Liquid Oxygen Tank on a sRLV

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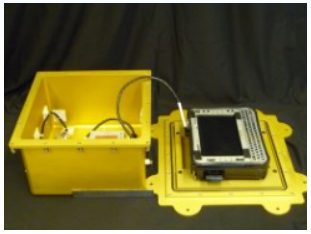
Flight Opportunities Program

STATUS QUO



- Propellant quantity gauging in low-gravity typically requires settling burns and the use of level sensors.
- The Radio Frequency Mass Gauge (RFMG) is capable of gauging in zero-g.
- RFMG is awaiting flight manifest

NEW INSIGHTS

Technology Focus Area: **Low-g cryogenic propellant quantity sensor**

***Specific Benefits of Technology*: Enables fast low-g gauging**

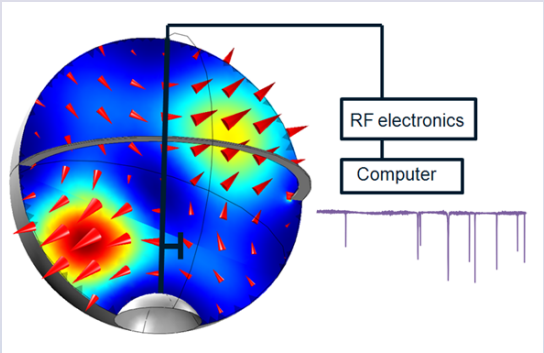
Testing on a sub-orbital reusable launch vehicle (sRLV) will provide critical test data with liquid oxygen to assess the performance of the gauge in low-g and in the presence of fluid sloshing.

MAIN ACHIEVEMENT:

In preparation for sRLV testing, the electronics box has been built and subjected to environmental testing to simulate launch conditions. Software modifications are complete and the unit is ready for flight. The payload is currently waiting to be manifested on a sRLV flight.

HOW IT WORKS:

The natural electromagnetic modes of the tank are excited by pinging the tank with an RF chirp signal via a small antenna mounted inside the tank. An RF electronics unit measures the RF power spectrum, and software identifies the peaks or mode frequencies. These frequencies are compared to a large database of RF simulations, and a best match occurs at some %fill level which is then reported back as the gauged %fill level.



SPEC'S/ IMPACT

Test Fluid: Liquid oxygen

Payload Mass/Dimensions: 13 lbs; 12“ x 12“ x 6"

RF power: < 1 mW

Frequency: 50 – 750 MHz

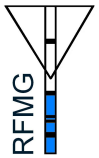
Gauging operations: Once per second, continuously

IMPACT: The RFMG provides a way to quickly gauge a tank in low-gravity without having to apply a settling thrust.

END-OF-PHASE GOAL

Demonstrate zero-g gauging in a sRLV liquid oxygen tank

- Advance elements of the technology to TRL-6 through low-g flights
- **Future:** Infuse RFMG technology into commercial launch vehicles and space-based payloads



The Radio Frequency Mass Gauge enables low-gravity gauging of cryogenic propellants.